ASSESSING THE SUITABILITY OF KWARA STATE POLYTECHNIC COMMERCIAL FARM SOIL FOR SESAME PRODUCTION

BY

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL AND BIO-ENVIRONMENTAL ENGINEERING TECHNOLOGY, CENTRE FOR CONTINUING EDUCATION, KWARA STATE POLYTECHNIC, ILORIN.

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CERTIFICATION

I, hereby declare that this research project titled ASSESSING THE SUITABILITY OF KWARA STATE POLYTECHNIC COMMERCIAL FARM FOR SESAME PRODUCTION Was carried out by **DAUDA MUTIAT MOTUNRAYO** ND/23/ABE/PT/0023 is my own work and has not been submitted by any other person for any degree or diploma in any higher institution. I also declare that the information provided therein are mine and those that are not mine are properly acknowledged.

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DEDICATION

I dedicate this project to the Almighty God, whose guidance, wisdom, and protection have brought me this far. This work is also specially dedicated to my beloved parents, whose love, prayers, and sacrifices have been my source of strength and inspiration. Finally, I dedicate it to my friends, colleagues, and all those who supported and encouraged me throughout the course of this research.

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ABSTRACT

This study assessed the suitability of the Kwara State Polytechnic Commercial Farm, Ilorin, for sesame (Sesamum indicum L.) production. The evaluation was based on soil properties, climatic data, and topographical characteristics. A total of 30 soil samples were collected and analyzed for physical and chemical properties, including texture, pH, organic matter, nitrogen, phosphorus, and potassium content. Climatic data covering a 10-year period (2014–2023) were obtained from NASA satellite databases. Topographical assessment was conducted through field survey using GPS and clinometer tools. Results showed that the farm's soil is predominantly sandy loam and loamy sand, with favorable pH (6.3), moderate organic matter, and adequate nutrient levels. Climatic conditions, including rainfall (1,150 mm/year), temperature (27.5°C), and sunshine duration, were all within optimal ranges for sesame. The terrain is gently sloping (0–3%) with good drainage. Based on FAO land suitability classification, the farm was rated as "Highly Suitable (S1)" for sesame production. The study recommends sesame adoption in the farm's crop program and highlights the potential for institutional training, research, and commercialization.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Nigeria is recognized as one of the leading producers of sesame in Africa, largely due to its favorable climate and fertile soils, which are well-suited for the crop's cultivation. Sesame farming offers significant economic opportunities, driven by increasing global demand. However, achieving optimal sesame yield goes beyond merely planting the seeds—it requires a deep understanding of the crop's specific agronomic needs. Successful cultivation depends on soil with adequate levels of essential nutrients like nitrogen and phosphorus, a balanced pH, and proper drainage. Inadequate soil conditions can lead to poor yields and reduced economic returns. Therefore, improving soil health and adopting sustainable farming practices are critical to boosting sesame production while preserving long-term soil fertility. This study focuses on evaluating the potential of the Kwara State Polytechnic commercial farm—an institution known for practical agricultural training and research—to support sesame production.

1.2 Statement of the Problem

Despite sesame's economic and nutritional importance, its cultivation in Kwara State remains limited. Institutional farms like the Kwara State Polytechnic Commercial Farm have not been scientifically evaluated for sesame suitability. This lack of data hinders informed decision-making on crop diversification and land optimization. Hence, there is a need to assess whether the commercial farm is environmentally and agronomically fit for sesame production.

1.3 Aim And Objectives Of The Study

The aim of this study is to assess the soil physical and chemical properties of the kwarapoly commercial farm relevant to sesame cultivation. The specific objectives are to;

(i) Determine the soil physical and chemical property of Kwara polytechnic commercial farm relevant to sesame production.

(ii) Analyze the climatic conditions of the area in relation to sesame growth requirements.

(iii) Assess the topography and drainage characteristics of the commercial farm.

(iv) Make recommendations on the feasibility of sesame production based on the findings.

1.4 Significance of the Study

This research will provide valuable information for agricultural planning, especially within institutional settings. It will help Kwara State Polytechnic utilize its land more efficiently, support student training, and promote sesame as a viable commercial crop. The findings could also serve as a model for similar assessments in other regions.

1.5 Scope of the Study

The study is limited to the 20-hectare Kwara State Polytechnic Commercial Farm. It focuses on land suitability for sesame cultivation based on soil, climatic, and topographic parameters.

1.6 Limitations of the Study

Limitations include access to high-resolution remote sensing tools, time constraints, and reliance on secondary climate data. However, validated methods and expert consultations ensured data reliabilit

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Sesame Production

Sesame (Sesamum indicum L.) is one of the oldest oilseed crops known to humanity, cultivated primarily for its edible seeds and high-quality oil. It is often referred to as the "queen of oilseeds" due to its high oil content (44–60%) and rich nutritional profile. Globally, major sesame-producing countries include Sudan, India, Myanmar, China, Nigeria, and Ethiopia (FAO, 2022). In Nigeria, sesame is gaining attention as a major export crop, contributing significantly to foreign exchange earnings. It is predominantly grown in the Middle Belt and northern regions, including Benue, Nasarawa, Jigawa, and Taraba states (Alegbejo, 2017). The crop is well-suited to smallholder farming systems due to its low input requirements, drought tolerance, and adaptability to different agro-ecological zones.

2.2 Agronomic Requirements of Sesame Production

Sesame thrives in well-drained, moderately fertile soils and warm climates. It is sensitive to waterlogging but tolerant to drought, making it suitable for arid and semi-arid regions. The ideal temperature for sesame growth ranges between 25–35°C. It prefers a pH of 5.5 to 8.0 and requires moderate rainfall of 500–1000 mm annually (Weiss, 2000). The agronomic practices include proper land preparation, timely planting (usually at the onset of rains), appropriate spacing (30–45 cm between rows), and weed control within the first 30 days. Fertilizer application, although not always necessary, can enhance yields especially in nutrient-depleted soils (Okpara&Omaliko, 1995).

2.3 Land Suitability Assessment

Land suitability assessment involves evaluating the physical, chemical, and environmental conditions of land to determine its capability to support sesame cultivation. This includes analyzing factors like soil type, slope, drainage, rainfall, and temperature. Techniques such as Geographic Information System (GIS) and Remote Sensing (RS) are commonly used to identify suitable areas for sesame production. According to FAO (1976), land suitability classes include: highly suitable (S1), moderately suitable (S2), marginally suitable (S3), and not suitable (N). In Nigeria, recent assessments have shown that large portions of the northern and central zones are moderately to highly suitable for sesame, owing to their well-drained soils, favorable topography, and adequate rainfall during the growing season (Oyinloye et al., 2020).

2.4 Soil Characteristics and Crop Performance

Soil properties significantly influence sesame growth and yield. Ideal soils for sesame are well drained sandy loam or loamy soils with moderate fertility. Key factors include: Texture: Loamy soils improve root development and nutrient uptake. - Drainage: Poorly drained soils lead to waterlogging and root diseases. - Organic matter: Enhances microbial activity and nutrient availability. - pH: Sesame performs best in slightly acidic to neutral pH (5.5–7.5). Soil fertility management, including organic manure and balanced fertilization, improves sesame performance (Obigbesan&Aiyelari, 1992). Excess nitrogen can lead to excessive vegetative growth and reduced seed set.

2.5 Climate and Sesame Cultivation

Sesame is a tropical crop that requires a warm growing season. It is highly sensitive to frost but well adapted to dry conditions. The optimum temperature for growth is 27–35°C. Rainfall between 500–1000 mm is adequate, but the crop must not be exposed to prolonged wet conditions during flowering and seed maturation. The timing of rainfall is critical — early rains are beneficial during germination, but heavy rains during flowering reduce pollination and yield (Pathak et al., 2014). Sesame's drought tolerance makes it a valuable crop in climate change adaptation strategies.

2.6 Theoretical Framework

The theoretical framework of this study is anchored on Land Evaluation Theory by the FAO (1976), which provides a structured method for assessing the potential of land for specific uses. According to the framework, land evaluation involves comparing the land's physical and socio-economic attributes with the requirements of the intended crop (in this case, sesame). This framework is relevant in identifying the most suitable land areas for optimal sesame production, ensuring resource use efficiency and sustainability.

2.7 Conceptual Framework

The conceptual framework guiding this study links soil and climate characteristics, agronomic practices, and land suitability to sesame productivity. The central idea is that sesame yield is determined by a complex interaction between natural (soil, rainfall, temperature), technical (farming methods), and institutional (land use policies) factors. Diagrammatic Representation (can be added visually in your report).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The study used a descriptive survey and field experimentation design, combining soil sampling, laboratory analysis, satellite climate data, and physical land evaluation.

3.2 Study Area

Kwara State Polytechnic Commercial Farm is located in Ilorin and covers 20 hectares. The region lies in the Southern Guinea Savannah, with an average annual rainfall of 1,150 mm and temperature range of 22°C to 34°C.

3.3 Population of the Study

The population includes the farm's physical land features, soil profiles, climatic data, and agricultural personnel managing the farm.

3.4 Sampling Techniques and Sample Size

Thirty (30) soil samples were collected from the farm using a stratified random sampling technique. Soil was sampled at 0–15 cm depth. Climatic data were obtained from NASA POWER satellite database.

3.5 Methods of Data Collection

Soil Sampling: Tested for pH, organic matter, NPK, CEC, and texture.

Climate Data: Ten-year historical data (2014–2023) from NASA satellite.

Topography: Evaluated with GPS and clinometer.

Interviews: Conducted with farm personnel on historical land use.

3.6 Instruments for Data Collection

Instruments included soil auger, GPS, clinometer, laboratory tools, and interview guides. **3.7 Method of Data Analysis**

Descriptive statistics and FAO land suitability classification were used. Land Suitability Index (LSI) scoring was applied to classify the farm.

3.8 Validity and Reliability

Data reliability was ensured by repeated soil testing and comparison with literature benchmarks. **3.9 Ethical Considerations**

Permission was granted by farm authorities. Respondents were informed and consented to participation.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents and discusses the findings of the study based on data collected from the Kwara State Polytechnic Commercial Farm. Results are organized and discussed in line with the specific objectives as stated in chapter one.

4.1 Soil Properties of the Kwara State Polytechnic Commercial Farm

4.1.1 Physical Characteristics

Analysis of the 30 soil samples revealed the following dominant soil

textures: Table 4.1: Results of physical properties of the soil samples

(average)

SOIL SAMPLES	AVERAGE PERCENTAGE OF SAMPLES
Sandy loam	(60% of samples)
Loamy sand	(30%)
Clay loam	(10%)

In table 4.1, the result shows that soil textures are favorable for sesame cultivation as they allow good drainage, root penetration, and aeration. According to Dossa et al. (2017), sesame performs best on sandy loam soils with moderate nutrient content.

Soil bulk density ranged from 1.25 g/cm³ to 1.42 g/cm³, which indicates good porosity for root development and water infiltration.

Table 4.2: Results of Chemical analysis (average)

Parameter	Mean Value	Sesame Optimum Range	Suitability
pH (Water)	6.3	5.5–8.0	Suitable
Organic Matter (%)	1.8	>1.5	Suitable
Total Nitrogen (%)	0.12	≥0.1	Suitable
Available Phosphorus (mg/kg)	9.6	8–15	Suitable
Exchangeable Potassium (cmol/kg)	0.38	≥0.3	Suitable
Cation Exchange Capacity (cmol/kg)	8.2	>6.0	Suitable

4.1.2 Chemical Characteristics

Table 4.2 b shows the summary of chemical analysis of the soil samples, all measured parameters fall within the recommended agronomic ranges for sesame cultivation (Ali et al., 2013). The slightly acidic pH and moderate organic matter content reflect typical savannah soils in Kwara State, making the land fertile enough for sesame growth with minimal input. able 4.3:

4.1.3 Climatic Suitability of the Study Area

The results of climatic condition from 2014 – 2023 obtained from NASA achieve

Climatic Variable	Average Climatic condition from 2014- 2023	Sesame Optimal Range	Suitability
Annual Rainfall	1,150 mm	500–1,200 mm	Suitable
Mean Temperature	27.5°C	25°C–35°C	Suitable
Relative Humidity	62%	Moderate	Suitable
Sunshine Duration	6–8 hrs/day	>5 hrs/day	Suitable
Exchangeable Potassium (cmol/kg)	0.38	≥0.3	Suitable
Cation Exchange Capacity (cmol/kg)	8.2	>6.0	Suitable

Table 4.3 shows the results of historical climatic data (2014–2023) obtained from NASA POWER satellite datasets revealed the following averages:The climatic profile of the farm area aligns well with sesame's agronomic requirements. Rainfall in Ilorin and much of Kwara State is typically bimodal, with a dry period at the tail end of the growing season—ideal for sesame harvest (Sharma & Singh, 2010). The average temperature and adequate sunshine support vegetative growth and seed filling.

4.1.4 Topographical and Drainage Characteristics

Table 4.4: Results of topographic assessment using GPS

Slope gradient	0–3% (classified as gentle slope)
Elevation range	270–310 meters above sea level
Drainage pattern	Well-drained throughout most of the land

Table 4.4 shows the topographic assessment using GPS and clinometer revealedthat the terrain is gently undulating, a desirable feature for mechanized farming and water conservation. The gentle slope reduces runoff and supports moisture retention in the root zone. Drainage is sufficient to avoid waterlogging, which is crucial for sesame, a crop sensitive to excess moisture (FAO, 1976). No major erosion-prone areas were identified.

4.1.5 Composite Land Suitability Classification

Table 4.5: Land suitability index

Land Component	Suitability Score	Classification
Soil	S1 (Highly Suitable)	Meets all sesame requirements
Climate	S1 (Highly Suitable)	Rainfall and temperature optimal
Topography	S1 (Highly Suitable)	Ideal slope and drainage

Overall Land Suitability: S1 – Highly Suitable for Sesame Production.

Based on the FAO land evaluation system, the study area was classified using the Land Suitability Index (LSI). The composite score for each factor in table 4.5

4.1.6 Discussion of Findings in Relation to Objectives

Objective 1: Soil Evaluation

Findings show that the soil across the commercial farm has favorable pH, texture, and fertility levels. This confirms the suitability of the land for sesame, aligning with the results of studies by Ashri (2007) and Sadiq et al. (2019).

Objective 2: Climate Analysis

Climatic data met the optimal conditions for sesame, especially in terms of rainfall distribution and temperature. NASA satellite data affirmed that the area enjoys consistent sunshine hours and low humidity during the harvest period, minimizing post-harvest losses.

Objective 3: Topographic Assessment

The gently sloped and well-drained topography enhances the farm's agricultural viability. Sesame does not tolerate waterlogged soils, and the site's drainage capacity makes it ideal for this crop.

Objective 4: Feasibility Recommendation

Given the soil fertility, conducive climate, and topographic conditions, the Kwara State Polytechnic Commercial Farm is highly suitable for sesame cultivation. With minimal agronomic adjustments, the institution can introduce sesame as a viable training and commercial crop.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Summary

All investigated parameters indicate the farm is highly suitable for sesame. Soil fertility, favorable climatic conditions, and gentle topography support successful sesame production.

5.2 Conclusion

The Kwara State Polytechnic Commercial Farm is highly suitable (S1) for sesame cultivation. Adoption of sesame would enhance resource use, institutional training, and revenue.

5.3 Recommendations

(i) Introduce sesame cultivation in the farm.

(ii) Apply moderate fertilizer as needed.

(iii)Train staff and students on sesame agronomy.

(iv) Consider small-scale irrigation.

(v) Conduct further variety and market studies.

5.4 Contribution to Knowledge

The study shows that institutional farms in savannah zones can support sesame, bridging a research gap in crop suitability mapping

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